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**The gnathiids from the Brazilian
 southeastern continental shelf and slope:
 distribution, ecological notes and description
 of three new species**

(Crustacea, Isopoda, Gnathiidae)

By Ana Maria S. Pires

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The gnathiids from the Brazilian southeastern continental shelf and slope are studied. The species were taken in water from 20 to 530 m depth. Four species were found: three new species are described (*Gnathia ubatuba*, *Gnathia ricardoi*, and *Gnathia andrei*) and *Bathygnaathia magnifica* Moreira, 1977 is reported for the first time since its description. The three new species are in the "Productae" section of the genus (Monod 1926). Depth, distribution and ecological data are presented.

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Introduction

During a broad oceanographic investigation on the tropical south Atlantic shelf ecosystem conducted in the Ubatuba region, northeastern São Paulo State, Brazil, the benthic fauna was intensively sampled from December 1985 to December 1988. Fourteen cruises obtained samples from 20 to 530 m depths and four species of gnathiids were found, three of them new.

The gnathiids were studied first due to their great abundance especially below the 70 m isobath. Furthermore, the group is poorly known from the Brazilian waters. The only report is that of Moreira (1977) describing a new species of *Bathygnaathia* from southwestern Atlantic deep waters.

The genus *Gnathia* was erected by Leach, 1813. Monod (1926) in his systematic revision of the Gnathiidae presented 53 species of *Gnathia* (s. str.) based on adult males, and described 21 of them. Camp (1988) listed the 38 species of the genus that had been known since Monod's revision. Later, Müller (1988, 1989a, b, 1991, 1993) added 9 new species to the genus and synonymized *G. puertoricensis* Menzies & Glynn with *Gnathia virginialis* Monod (Müller 1993). So, the genus currently has 99 species based on adult males. The three new species described herein belong to Monod's section "Productae" (Monod 1926) because they have the frontal margin of head broadly elevated at middle.

The benthic shelf break region (100 to 150 m deep) off São Paulo State is characterized by patches of calcareous algae (Melobesiacea, free living or concreted) surrounded by sand or muddy sand (Kempf 1972). The calcareous substratum is highly suitable for burrowing animals like polychaets, sipunculids and gnathiids, which inhabit the canals between the algal lamina. Gnathiids found in those spaces were living in groups, that is, one adult male was found together with both a number of pranzia and adult females or only with pranzia larvae and/or immature males.

Material and Methods

The material was collected during eight cruises of the research trawler "Veliger II" over the inner shelf (10 to 50 m depths) and six cruises of R/V "Prof. W. Besnard" over the outer continental shelf and continental slope (50 to 530 m) of Ubatuba region, São Paulo State, Brazil. The whole area is between latitudes 23°34' S to 24°49' S and longitudes 44°13' W to 45°09' W (Tab. 1).

The animals were sampled with a rectangular dredge, a beam trawl, and a 0,1 m² van Veen grab. In the laboratory the sediment was sorted under a binocular stereomicroscope, and the hard substrate (calcareous algae and corals) was broken up to obtain the burrowers and discarded. When the animals were picked up from each fragment, they were counted and their stage of development determined. The specimens were preserved in alcohol 70 %.

The type material is deposited in the following institutions: Museu de Zoologia, Universidade de São Paulo (MZSP), Museu Nacional do Rio de Janeiro (MNRJ) and Instituto Oceanográfico da Universidade de São Paulo (IOUSP).

Bathynathia magnifica Moreira, 1977

Bathynathia magnifica Moreira, 1977: 12, Figs 1-17 (holotype male, Brazil: off State of Santa Catarina, 387 m depth, 170, P.S. Moreira coll. MZSP, examined); Camp 1988: 674.

Only one adult male of *B. magnifica* was collected at 240 m. The occurrence is the shallowest and most northeastern record of the species.

Gnathia ubatuba, spec. nov.

Figs 1-18

Types. Holotype: ♂, Brazil. São Paulo State, Ubatuba continental shelf, Sta. 4856, 24°13'S, 44°45'W, 110 m depth, 17.12.1985, R/V "Prof. W. Besnard" coll. (MZSP, cat. No. 11510). – Paratypes: 20♂♂, 2♀♀, 12 praniza, idem (18 MZSP 11511, 16 paratypes 3230); 36♂♂, 12♀♀, 24 praniza, Sta. 4948, 24°01'S, 44°33'W, 105 m depth, 26.07.1986, R/V "Prof. W. Besnard" coll. (36 MZSP 11512, 36 MNRJ 3231).

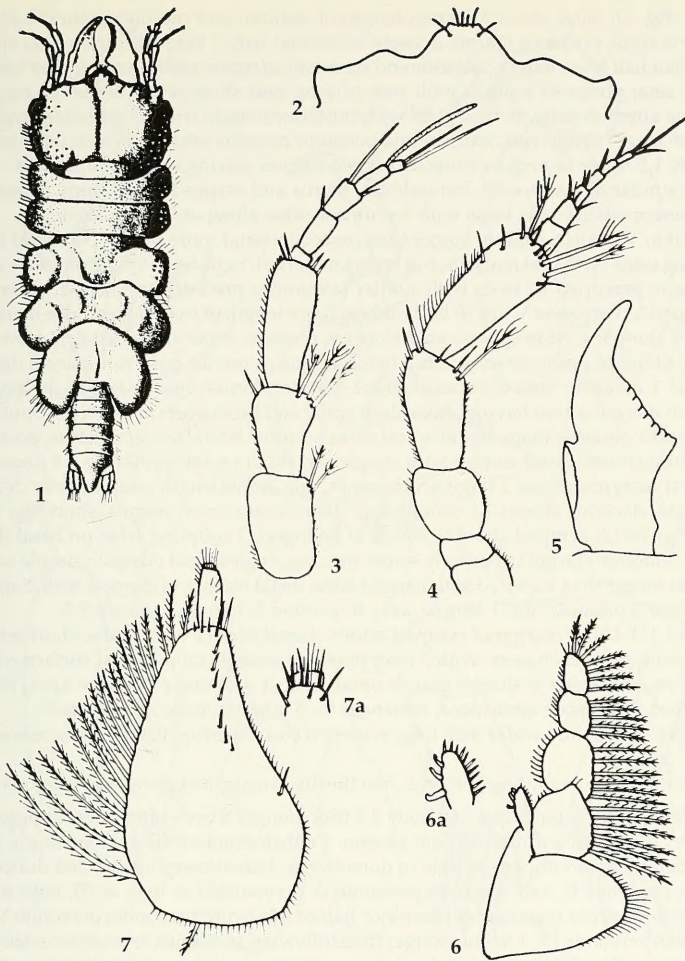
Additional material. Besides the selected types, 358 specimens in different growth stages were examined from the area of study and deposited at IOUSP.

Description

Holotype adult male 3.8 mm long (Fig. 1). Body nearly 2.8 times longer than wide, light brown or white colored; integument indurate, with simple setae all around; small tubercles laterally placed on head and pereonites II-IV. Head about 1.5 times wider than long, frontal margin with central protrusion bearing 6 apical setae (Fig. 2), anterior and median dorsal surface excavated, dark brown eyes laterally protruded. Pereonite I nearly half pereonite II length, laterally fused to head. Pereonites II-III almost subequal in length, excavate anteriorly. Pereonite IV as long a second and third pereonites together, deeply excavate middorsally. Pereonite V directed backwards with dorsal round lobes. Pereonite VI strongly bent backwards, distal margin extending beyond pleonite 2, twice length of anterior pereonite and 7 times longer than pereonite VII. Pereonite VII shorter than pleonite 1 with lateral margins embedded into pereonite VI. Pleon with 5 pleonites subequal both in length and width, coxal plates not visible from dorsal view; pleotelson broadly triangular apex straight nearly twice uropodal endopod length; uropod endopods slightly surpassing and exopods not reaching apex of pleotelson.

Antenna 1 (Fig. 3). Peduncle articles 1 and 2 almost subequal in length with 2-3 broom setae inner distally placed; article 3 longest, 1/3 longer than article 2. Flagellum of 5 articles, first article shortest, ring-like, as wide as following 2 articles; article 4 narrow, bearing elongate aesthetasc.

Antenna 2 (Fig. 4). Peduncle of 5 articles, first two narrower than following articles; article 2 shortest, 1/5 length of article 5; article 3 half length of last peduncular article; article 4 bearing short setae along margin and long feather bristle and 3 simple setae distally placed; article 5 slightly longer than



Figs 1-7. *Gnathia ubatuba*, spec. nov. 1-2. Holotype, adult male, 3.8 mm long. 3-7. Paratype, adult male, 3.7 mm long. 1. Body, dorsal view. 2. Frontal margin of head. 3. Antenna 1. 4. Antenna 2. 5. Mandible. 6. Maxilliped. 6a. Lateral lobe with 3 coupling-hooks. 7. Pylopod. 7a. Tip of pylopod.

flagellum, with many short setae along outer margin and 8 simple setae and 3 feather-like bristles. Flagellum of 6 articles narrowing distally, last article with 1 long and 2 short apical simple setae.

Mandible (Fig. 5) large, stout, nearly $\frac{1}{2}$ body length; frontal lamina with minute denticles, apex blunt elongate curved inwards; lateral outer margin bent ventrally.

Maxilliped (Fig. 6). Basis as long as palp articles 1 to 3 together, outer margin strongly curved, setose, inner margin straight with distal lobe bearing 3 coupling-hooks and many short setae. Four distal articles bearing finely fringed setae shortening distalwards.

Pylopod (Fig. 7) of 3 articles; article 1 pear-shaped nearly 4.5 times longer than following articles together, outer distal surface with longitudinal row of simple setae, long plumose setae along inner margin, basal and outer margins fringed by fine setae; article 2 about 10 times longer and slightly wider than apical article, surface of upper half bearing simple setae; article 3 twice wider than long with fine setae placed along apex.

Pereopod I (Fig. 8). Basis about 1.3 times length of ischium and merus together, 4 plumose setae along anterior margin, posterior margin densely setose and with 1 longer plumose seta apically placed; ischium less than half basis length, anterior and posterior margins with distal quarter bearing 1 stout long plumose seta; posterior margin with row of long and short setae; merus as long as carpus, 2 plumose setae anterodistally, both articles with posterior margin fringed with long and short setae; propodus twice length of dactylus, anterior and posterior margins setose, a broom setae anterodistally; dactylus nearly 1.5 times as long as elongate curved unguis, having apical simple seta.

Pereopod II similar to pereopod I, but ischium, merus and carpus having spiny posterior margins like those of pereopods III to V; basis with 8 plumose setae along anterior margin.

Pereopods III to V similar, slightly longer than precedents and more setose; pereopod III basis with 11 plumose long setae on lateral margins, 6 at anterior margin, ischium having 6 plumose setae at basal posterior margin; pereopod IV basis with similar setation as precedent pereopod, other articles like those of pereopod V. Pereopod V (fig. 9) basis almost twice length of ischium, anterior margin crenulate at basal third, 2 short and wide spines and 2 elongate plumose setae along distal $\frac{2}{3}$, posterior margin setose bearing 4 long plumose setae; ischium twice as long as merus, posterior margin densely setose, 2 plumose and 1 elongate simple setae at distal anterior corner; merus nearly as long as carpus, posterior lateral margin setose having short blunt spine and broom seta at distal end, anterior margin with 3 simple and 1 plumose long setae at apical corner; carpus lateral margins setose, posterior margin with 2 short blunt spines, distal surface with simple and broom setae; propodus 2.4 times longer than dactylus, lateral margins setose, 2 large acute spines, one at midlength and one near distal corner of posterior margin; dactylus almost 1.5 times longer than stout curved unguis, short seta distally.

Pleopods (Figs 10-12) sympod about $\frac{1}{3}$ length of endopod, 2 coupling setae on basal third of inner lateral margin, anterior margin irregularly setose bearing single apical elongate simple seta; endopod nearly 1.2 times longer than exopod, distal margins bare; distal margin of exopod with 2 opposing setae in exopod 1, with 3 plumose and 1 simple setae in exopod 2, bare in exopods 3-5.

Uropods (Fig. 13). Outer margin of sympod setose, dorsal surface with sparse short setae; endopod slightly surpassing pleotelson apex, with 3 long plumose setae distally, dorsal surface with few setae mediolaterally; exopod about $\frac{1}{2}$ shorter than exopod, almost reaching pleotelson apex, lateral margin basal third setose, 3 plumose setae along remanent $\frac{2}{3}$, 3 long plumose apical setae.

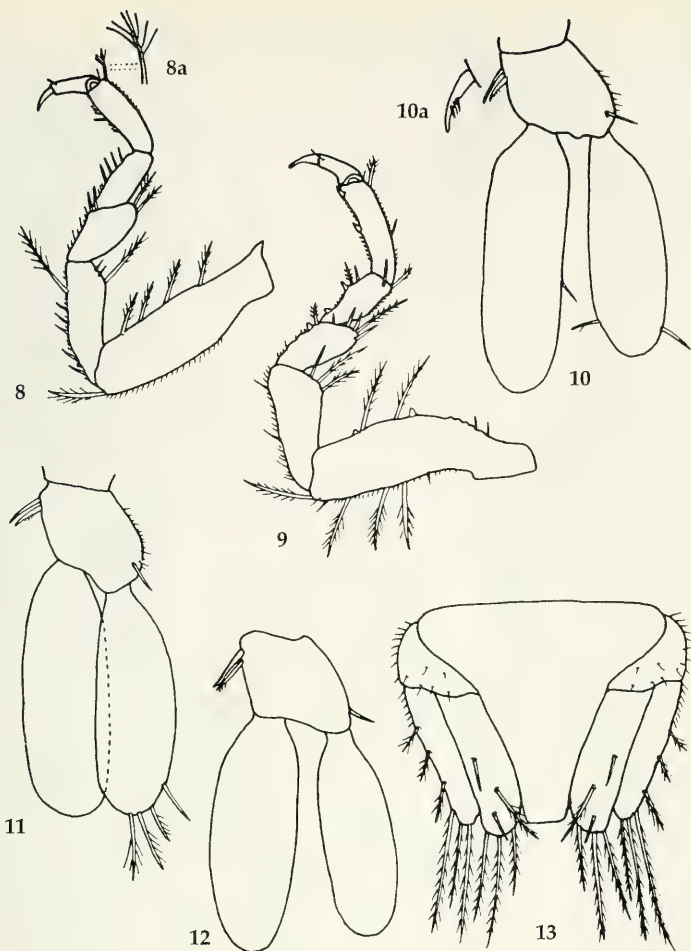
Pleotelson (Fig. 13) slightly wider than long, widest at base tapering distally; apex as wide as $\frac{1}{8}$ basal width, bare.

Remarks. Some males, including holotype, had the distal margin of pleopodal exopods 1 and 2 bare.

Ovigerous female, 3.5 m long (Fig. 14). Body 2.3 times longer than wide, widest at posterior margin of pereonite IV, yellowish with translucent pereon. Cephalothorax thrice pleon length. Head nearly thrice wider than long, mouthparts visible in dorsal view; lateral margins directed dorsally; pereonite I embedded in pereonite II, half length of pereonite II; pereonite II as long as III, both having lateral margins directed upwards together with anterior half of following pereonite; pereonite V longest, 1.2 times longer than pereonite IV, 1.5 times longer than following pereonite, few sparse setae along lateral margins; pereonite VI with incomplete lateral suture, distal corner triangular, lateral margins bearing some setae; pereonite VII very short, about 30 times shorter than pereonite V. Pleonites slightly increasing in length posteriorly, coxal plates visible dorsally on pleopods 4-5; pleotelson as long as wide, uropods slightly projecting beyond pleotelson apex. Pylopod (Fig. 15) of 4 articles; article 1 globose, 1.4 times longer than wide, with large strong basal seta, lateral distal margin irregularly setose; article 2 1.6 times wider than long, lateral and distal margins setose; article 3 almost half as wide than preceding article, 1.5 times longer than wide, lateral margins bearing many setae; apical article short, globose, about $\frac{1}{6}$ length of article 3, margins setose. Pereopods all similar to pereopod I with fewer setae. Pereopod I (Fig. 16) basis longer than following 2 articles, anterior margin with single short broom seta; ischium 1.3 times longer than merus, anterior margin bearing basal simple seta and distal elongate broom seta, posterior margin sparsely setose; merus having 2 long simple setae at distal anterior corner, 2 elongate and some short setae on posterior margin; carpus about 0.7 times length of propodus, posterior margin setose bearing single elongate seta; propodus 2.4 times longer than dactylus, 1 broom seta distally placed at anterior margin; unguis curved, slightly shorter than in males.

Remarks. All females studied were gravid bearing 26-30 eggs in the marsupium.

Last stage pranzia, 3.9 mm long. Pylopod (Fig. 17) very few setose with distal serrate spine; propodus half length of all 3 precedent articles; dactylus large prehensile, nearly 3 times length of unguis.



Figs 8-13. *Gnathia ubatuba*, spec. nov. 8-11, 13. Paratype, adult male, 3.7 mm long. 12. Holotype, adult male, 3.8 mm long. 8. Pereopod I. 8a. Apical setae of propodus. 9. Pereopod V. 10. Pleopod 1. 10a. Coupling setae of sympod. 11. Pleopod 2. 12. Pleopod 5. 13. Pleotelson with uropods.

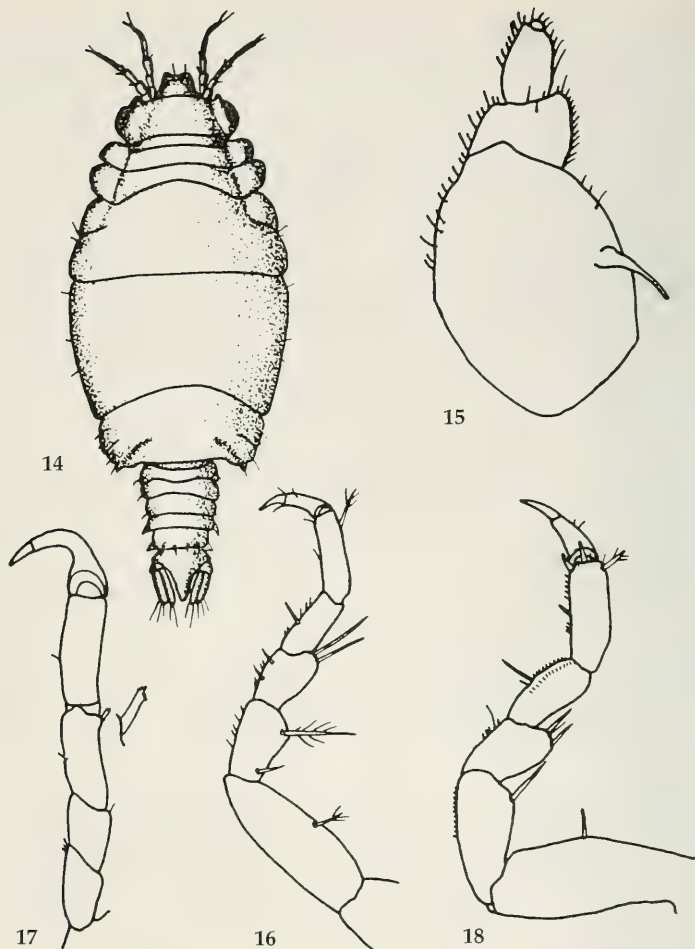
Pereopod I (Fig. 18) similar to that of female except by 2 rows of short setae laterally on carpus, 2 strong spines placed at distal margin of propodus, and longer acute unguis slightly shorter than dactylus.

Distribution. Southeastern Brazil: São Paulo State, Ubatuba continental shelf and upper slope.

Etymology. Ubatuba is the type locality of the new species.

Habitat. The species was found in hard, sandy bottoms on the continental shelf, between 20 and 320 m depth and in a thermal range of 13 to 25 °C. It was especially abundant in crevices of the calcareous hard bottoms from the outer shelf and shelf break region, between 100 and 130 m depth.

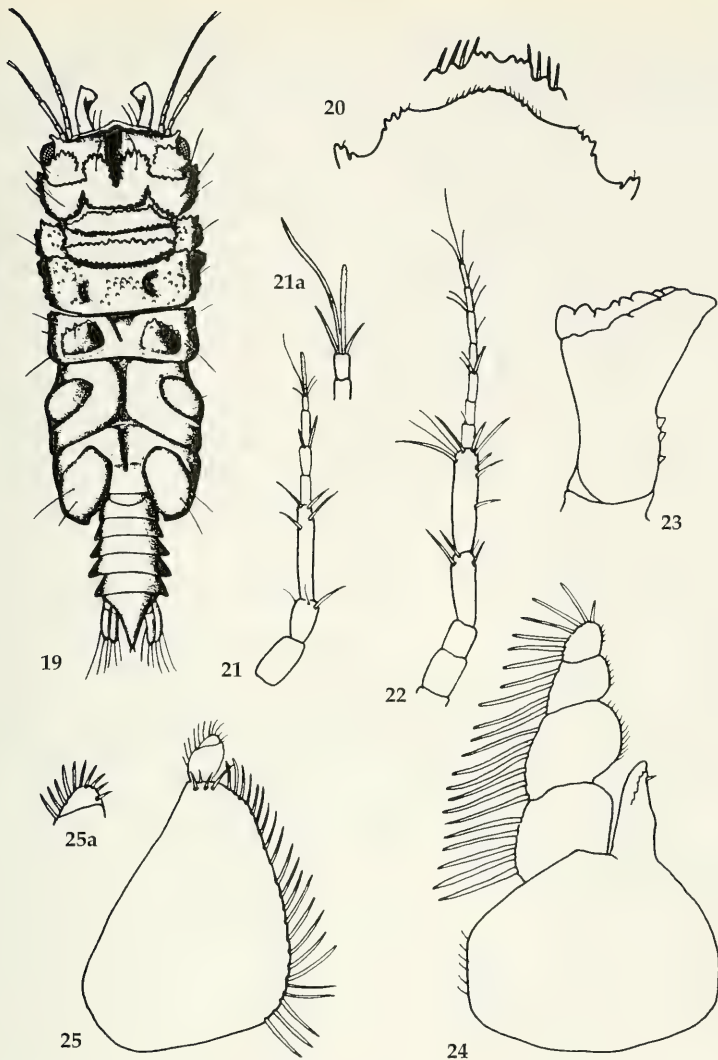
Taxonomic discussion. *Gnathia ubatuba* resembles *G. polaris* Hodgson from Antarctic waters (see Brandt & Wägele 1991, for nomenclatural status of *Gnathia polaris*). However, *Gnathia ubatuba* differs mainly by having body less setose, pereonites V-VI larger and bent backwards, pereonite VII plus pleonites 1-2 englobed by pereonite VI, mandible incisive process with an elongate apex curved



Figs 14-18. *Gnathia ubatuba*, spec. nov. 14-16. Adult female, 3.5 mm long. 17-18. Pranzia, 3.9 mm long. 14. Dorsal view. 15. Pylopod. 16. Pereopod I. 17. Pylopod. 18. Pereopod I.

inwards, maxilliped with 3 coupling hooks. Other important differences are in shape and relative proportions between pleopods rami and on several aspects of the morphology of the pereopods, uropods and pleotelson. Females of both species are different in general body outline. *Gnathia ubatuba* has head and pereonites II-IV bent upwards and a remarkable lateral depression along these segments, which is absent in *G. polaris*. The latter has a smooth body, gently curved ventrally.

Biology. Adults predominated below 100 m depth, and pranzias were more numerous in shallower water. Males always were more abundant than females, varying in number from 2 to 10 times more at the different sites. The gnathiids were found in groups, inhabiting the spaces within the calcareous lamina of *Melobesia* (algae Corallinaceae) or into exoskeletons of dead corals (*Caryophyllia ambrosia*). Generally several pranzias and/or a few immature males and/or few mature females were associated with a mature male. Group behavior of gnathiids was noted earlier by Amanieu (1969) and other workers in gnathiids from the European coasts.



Figs 19-25. *Gnathia andrei*, spec. nov. 19-20. Holotype, adult male, 2.5 mm long. 21-25. Paratype adult male, 2.4 mm long. 19. Dorsal view. 20. Frontal margin of head. 21. Antenna 1. 21a. Tip of antenna 1. 22. Antenna 2. 23. Mandible. 24. Maxilliped. 25. Pylopod. 25a. Tip of pylopod.

Gnathia andrei, spec. nov.

Figs 19-33

Types. Holotype: ♂, Brazil. São Paulo State, Ubatuba continental slope, Sta. 5120, 24°19'6"S, 44°40'6"W, 134 m depth, 10.07.1987, R/V "Prof. W. Besnard" coll. (MZSP, cat. No. 11517). - Paratypes: 8♂♂, idem (5 MZSP 11518, 3 MNRJ 3234); 5♂♂, 4♀♀, Sta. 5148, 24°14'S, 44°32'W, 134 m depth, 12.07.1987, R/V "Prof. W. Besnard" coll. (MZSP 11519); 3♂♂, 7♀♀, Sta. 5170, 24°09'S, 44°22'5"W, 136 m depth, 13.07.1987, R/V "Prof. W. Besnard" coll. (MNRJ 3235); 1♂, Sta. 5192, 24°23'2"S, 44°24'8"W, 180 m depth, 20.07.1987. R/V "Prof. Besnard" coll. (MZSP 11520).

Description

Holotype adult male 2.5 mm long (Fig. 19). Body nearly 3.0 times longer than wide, with few widely spaced simple long setae; head and first three pereonites white, indurate, other somites light brown, soft. Head about 1.8 times wider than long, frontal margin slightly protruded, dentate, with a row of short setae (Fig. 20), lateral margins dentate; dorsal surface with 2 dentate latero-dorsal plates behind eyes, large dorsal plate bifurcating at middle, each branch almost apex of ocular plate; eyes not protruded, lateral. Pereonite I nearly 0.3 times shorter than pereonite II, laterally fused to head, covered by a calcareous dentate plate. Pereonites II-III subequal in length, pereonite II with lateral lobes pitted, a calcareous dentate plate centrally placed. Pereonite III densely pitted. Pereonite IV slightly longer than pereonite I, lateral margins anteriorly excavate, 2 large lobes laterally placed. Pereonite V largest, with lateral broadly elongate lobes. Pereonite VI posterolateral margin reaching middle of pleonite 2, apex acute bent inwards, 2.3 times length of pereonite I and almost 8 times pereonite VII length. Pereonite VII shorter than pleonite 1. Pleon with 5 pleonites slightly increasing in length posteriorly, acute xocal plates visible in dorsal view; pleotelson triangular apex acute, with 2 terminal short setae; uropodal endopods shorter than pleotelson apex.

Antenna 1 (Fig. 21). Peduncle articles 1-2 almost subequal in length; article 3 as long as article 2 and 3 together. Flagellum 4 articulate, slightly longer than last peduncular article, apex bearing 1 aesthetasc.

Antenna 2 (Fig. 22). Three basal peduncle articles short; article 5 about 1.5 times length of article 4, with many elongate setae along lateral and distal margins. Flagellum of 7 articles, nearly 1.8 times longer than last peduncular article; distal articles longer than proximal articles.

Mandible (Fig. 23) short, about $\frac{1}{11}$ the body length; frontal lamina with broad denticles, inner corner protruded inwards; lateral inner margin with 3 acute spines.

Maxilliped (Fig. 24). Basis longer than palp articles 1-4 combined, inner margin with large elongate lobe bearing 1 coupling hook; palp articles with many elongate simple setae along outer margins, few short setae on inner margins.

Pylopod (Fig. 25) basal article about 5.6 times longer than following articles together, outer and distal margins having a row of long simple setae; article 2 elongate, about 4 times longer than apical article, lateral inner margins of both fringed with simple setae.

Pereopod I (Fig. 26). Basis slightly longer than ischium and merus together, anterior margin having row of elongate fine simple setae and 1 conical spine placed at distal third; ischium about $\frac{3}{4}$ length of basis, few elongate setae along posterior margin, 3 prominent long setae anterodistally; merus almost as long as carpus, 4 conical spines and some long setae placed along posterior margin; carpus with 1 basal conical spine and long hairy setae on posterior margin; propodus thrice length of dactylus, posterior margin with short and long spines, anterior margin with short hard setae needle-like; unguis near half length of dactylus, apex blunt.

Pereopod II-III similar, slightly shorter than precedents. Pereopod II (Fig. 27) basis having 3 acute projections and some elongate simple setae on anterior margin; ischium almost twice length of precedent article, merus and carpus subequal in length, each with 1-2 conical spines on posterior margin; propodus nearly 2.5 times dactylus length, 2 elongate acute spines on posterior margin; dactylus twice as long as wide, unguis having 3 short apical setae.

Pereopods IV-V similar (Fig. 28), slightly longer than precedents without spines on basis, merus and carpus; propodus with 4 groups of 1 elongate acute spine plus 1-2 elongate setae along posterior margin; dactylus about 1.5 times longer than elongate narrow unguis, 3 short setae distally.

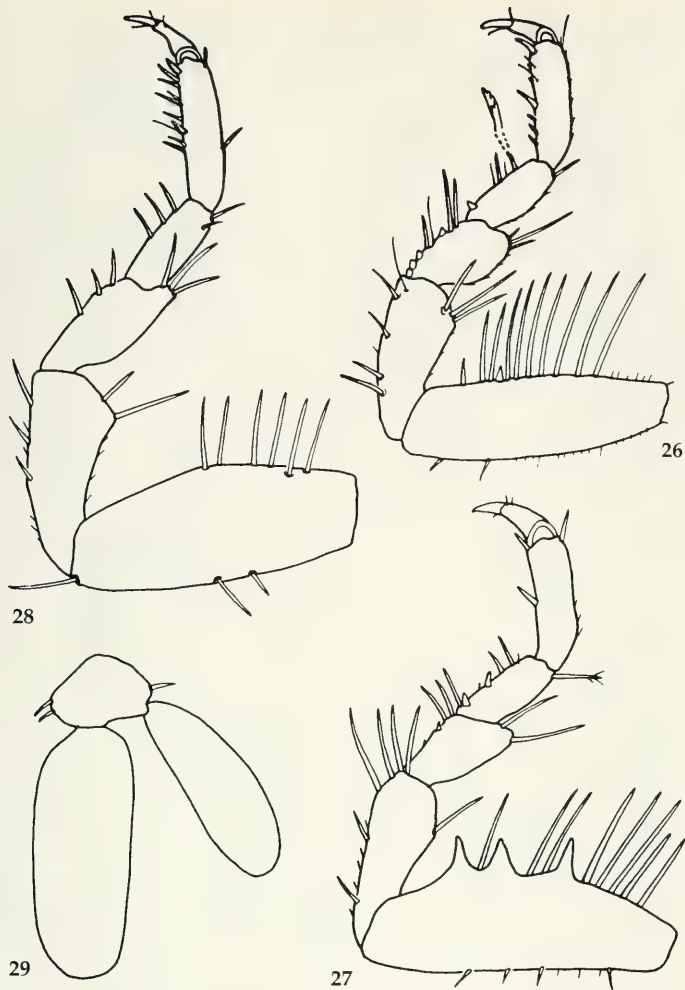
Pleopods 1-5 similar (Fig. 29), sympod nearly 4 times shorter than endopod, 2 coupling setae centrally placed at inner lateral margin, outer margin with elongate simple seta; edopod nearly 1.3 times longer than exopod, both articles bare.

Uropods (Fig. 30). Sympod bare; endopod reaching pleotelson apex, subequal in length to exopod, many plumose setae sub-apically and apically placed on both articles.

Pleotelson (Fig. 30): 1.3 times longer than wide, tapering posteriorly to broad rounded apex having 2 short setae.

Remarks. Adult males varied from 2.3 to 2.5 mm length.

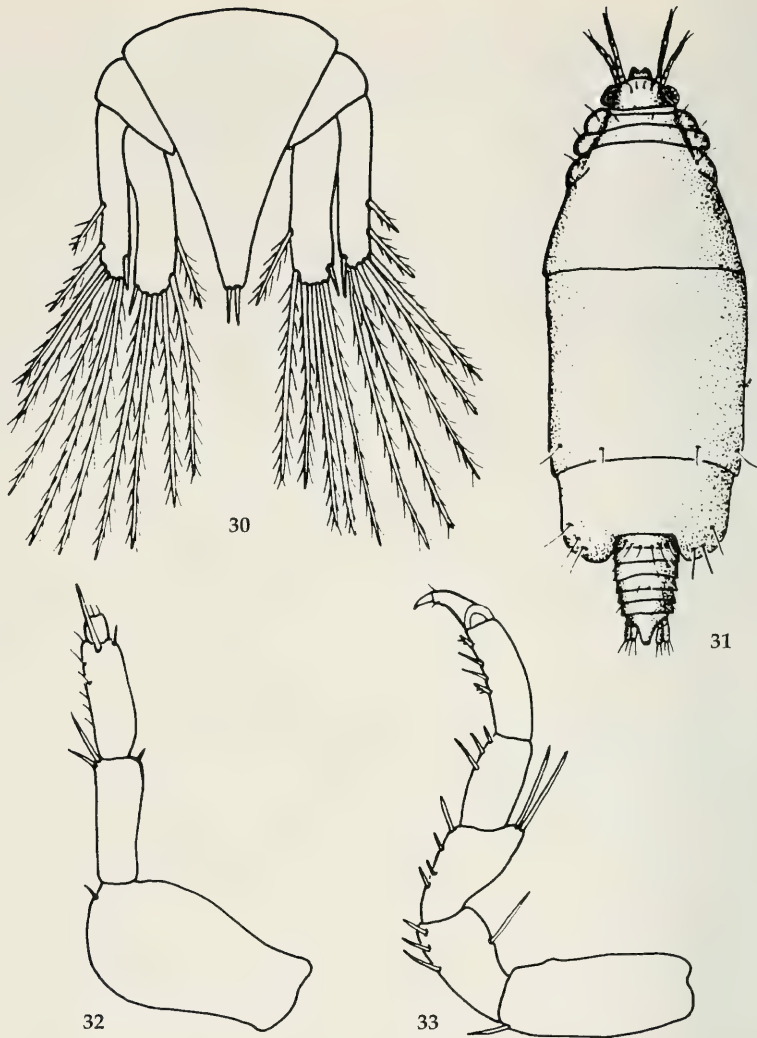
Ovigerous female, 2.5 mm long (Fig. 31). Body elongate about 2.8 times longer than wide, widest at pereonites IV and V junction, white, few setae placed along posterior margins of pereonites. Head about 2.4 times wider than long, mouthparts visible in dorsal view; cephalothorax nearly 5 times as long as pleon. Pereonite I embedded in pereonite II, $\frac{1}{2}$ length of pereonite II; pereonite II as long as III, both



Figs 26-29. *Gnathia andrei*, spec. nov., paratype adult male, 2.4 mm long. 26. Pereopod I. 26a. Dentate setae from carpus. 27. Pereopod II. 28. Pereopod V. 29. Pleopod I.

having lateral margins directed slightly upwards; pereonite V longest, 1.5 times longer than pereonite IV, 2.5 times longer than following pereonite; pereonite VI posterolateral margin reaching pleopod 1 posterior margins; pereonite VII short, about 12 times shorter than pereonite V. Pleonites subequal in length, coxal plates not visible dorsally; pleotelson as long as wide, uropods reaching pleotelson apex. Pylopod elongate (Fig. 32). first article 1.7 times longer than wide, lateral margin bare; articles 2-3 elongate, subequal in length 1 long seta and few short setae distally; apical article almost 4.4 times shorter than precedent article, distal margin with 2 short setae. Pereopods all similar to pereopod I. Pereopod I (Fig. 33) basis as long as merus and carpus together, anterior margin bare; ischium, merus and carpus nearly subequal in length, posterior margin with scattered elongate setae; propodus twice longer than dactylus, 2 elongate setae and 2 spines on posterior margin; unguis $\frac{1}{3}$ length of dactylus.

Remarks. Fourteen adult females were obtained in a total of 35 specimens.



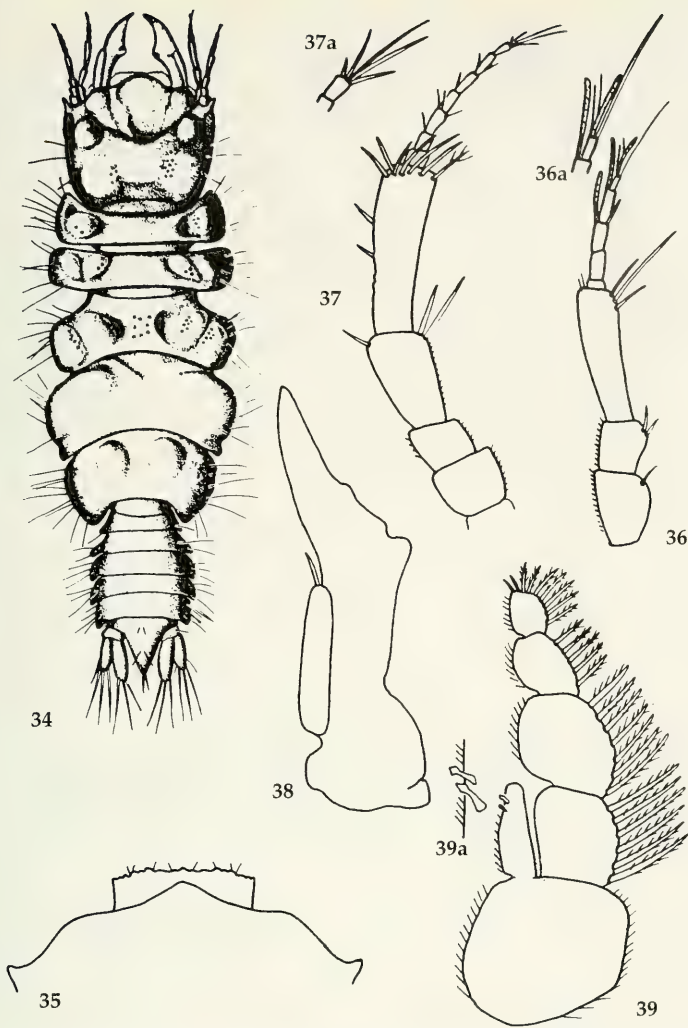
Figs 30-33. *Gnathia andrei*, spec. nov. 30. Paratype adult male, 2.4 mm long. 31-33. Paratype adult female, 2.5 mm long. 30. Pleotelson with uropods. 31. Dorsal view. 32. Pylopod. 33. Pereopod I.

Distribution. Southeastern Brazil: São Paulo State, shelf break region offshore of Ubatuba.

Etymology. The species is named after my younger son, André.

Habitat. *Gnathia andrei* occurred only in the shelf break zone, between 134 and 180 m depth, in dead corals.

Taxonomic remarks. *Gnathia andrei* is unique because it has conspicuous calcareous dentate plates on head and pereonites I to III.



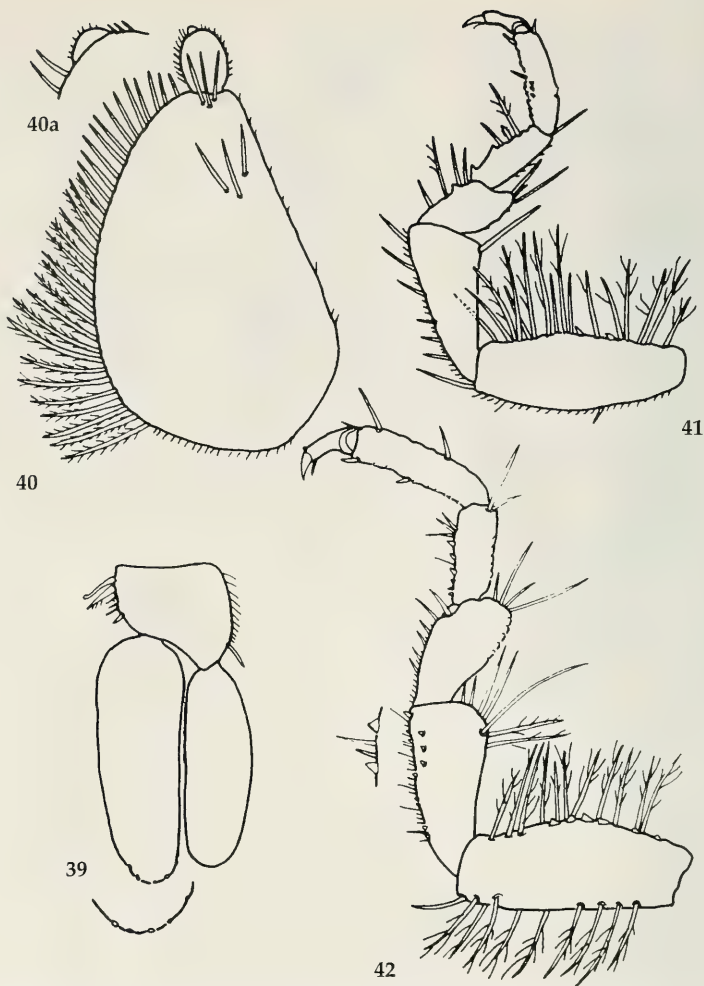
Figs 34-39. *Gnathia ricardoii*, spec. nov. 34-35. Holotype adult male, 5.5 mm long. 36-39. Paratype adult male, 5.6 mm long. 34. Dorsal view. 35. Frontal margin of head. 36. Antenna 1. 36a. Tip of antenna 1. 37. Antenna 2 (basal article missing). 37a. Tip of antenna 2. 38. Mandible. 39. Maxilliped. 39a. Coupling hooks enlarged.

Gnathia ricardoii, spec. nov.

Figs 34-47

Types. Holotype: ♂, Brazil, São Paulo State, Ubatuba continental slope, Sta. 5365, 24°25'S, 44°16'5"W, 320 m depth, 07.12.1988, R/V "Prof. W. Besnard" coll. (MZSP, cat. No. 11513). - Paratypes: 11 ♂♂, idem (8 MZSP 11514, 4 MNRJ 3232); 4 ♂♂, 4 ♀♀, 1 praniza, Sta. 5361, 24°42'S, 44°30'5"W, 320 m depth, 06.12.1988, R/V "Prof. W. Besnard" coll. (5 MZSP 11515, 4 MNRJ 3233); 1 ♂♂, Sta. 5362, 24°48'8"S, 44°29'7"W, 520 m depth, 07.12.1988, R/V "Prof. W. Besnard" coll. (MZSP 11516).

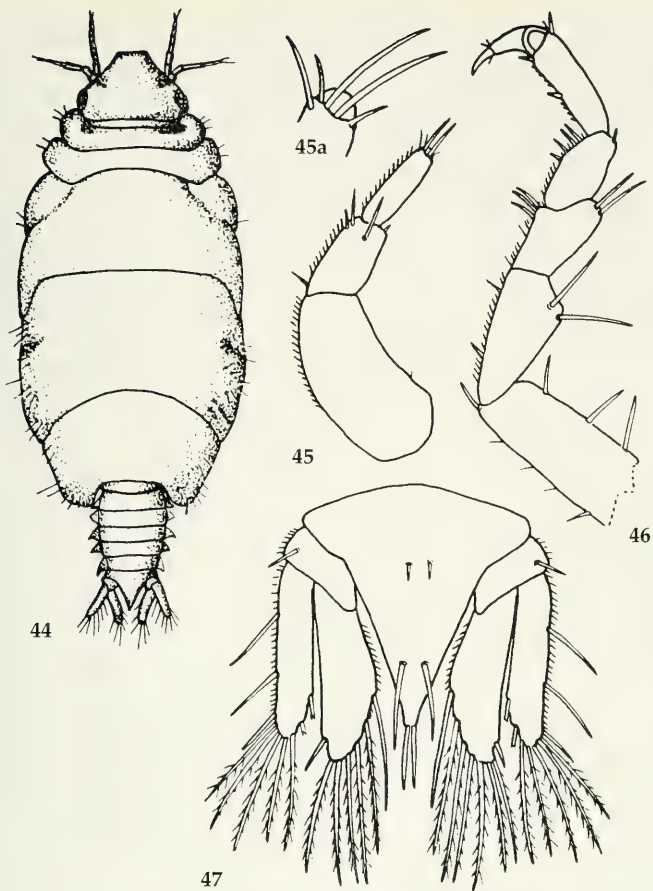
Additional material. Besides the selected types, 26 specimens in different growth stages were examined from the area of study.



Figs 40-43. *Gnathia ricardoii*, spec. nov., paratype adult male, 5.6 mm long. 40. Pylopod. 40a. Tip of pylopod. 41. Pereopod I. 42. Pereopod VI. 43. Pleopod I.

Description

Holotype adult male 5.5 mm long (Fig. 34). Body about 3.2 times longer than wide, with many simple long setae laterally; few small tubercles laterally on head and pereonites II-III, laterally and centrally on pereonite IV. Head about 1.2 times longer than wide, frontal margin broadly protruded (Fig. 35), anterior and median dorsal surface deeply excavated, 2 elongate latero-dorsal lobes, lamina dentata between mandibles visible in dorsal view, eyes lateral. Pereonite I 2.5 times shorter than pereonite II, laterally fused to head. Pereonites II-III almost subequal in length, both with lateral lobes. Pereonite IV almost twice pereonite I length, 2 large lateral lobes directed slightly backwards. Pereonite V largest, with lateral broadly rounded lobes. Pereonite VI posterior margin extending beyond pleonite 1, twice length of pereonite I, almost 4 times pereonite VII length. Pereonite VII longer than pleonite 1 with lateral margins straight. Pleon with five pleonites subequal in length, coxal plates visible in dorsal view; pleotelson triangular apex acute, bearing 2 terminal and 4 dorsal setae; uropodal endopods



Figs 44-47. *Gnathia ricardoï*, spec. nov. 44-46. Paratype adult female, 5.0 mm long. 47. Paratype adult male, 5.6 mm long. 44. Dorsal view. 45. Pylopod. 45a. Tip of pylopod. 46. Pereopod I. 47. Pleotelson with uropods.

surpassing apex of pleotelson.

Antenna 1 (Fig. 36). Peduncle article 1 slightly longer than article 2, short setae along outer margin; article 3 as long as article 1 and 2 together. Flagellum of 5 articles, first article shortest, articles 3 to 5 with one distal elongate aestetasc.

Antenna 2 (Fig. 37). Three basal peduncle articles short; article 5 about 1.7 times length of article 4, slightly shorter than flagellum, with many elongate setae along distal margin. Peduncle of 7 articles elongating distally.

Mandible (Fig. 38) narrow, elongate, about $\frac{1}{8}$ body length; frontal lamina barely dentate, with straight elongate apex; lateral carina with 1 apical seta. maxilliped (Fig. 39). Basis as long as palp articles 1-3 together, outer margin strongly curved, setose, inner margin straight with large elongate lobe bearing 2 coupling-hooks and many short setae; palpal articles having elongate plumose setae on outer margins, many short simple setae along inner margins.

Pylopod (Fig. 40) basal article nearly 4.5 times longer than following articles together, outer margin with row of two kinds of setae: plumose in the basal $\frac{2}{3}$, simple in the distal third; article 2 rounded, about 10 times longer than apical article, lateral margins fringed with short setae.

Pereopod I (Fig. 41). Basis same length as ischium and merus together, many elongate fine hairy setae

and 2 conical spines along anterior margin, posterior margin densely setose; ischium about $\frac{3}{4}$ length of basis, many short and long setae along posterior margin, anterodistal corner bearing elongate setae; merus shorter than carpus, conical spine and many setae along posterior margin; carpus with 2 conical spines and long hairy setae on posterior margin; propodus twice length of dactylus, posterior margin basal half with scales; dactylus nearly twice as long as strong unguis, bearing apical simple seta.

Pereopod II similar to pereopod I, but ischium, merus and carpus having spiny posterior margins like pereopods III to V; basis with 8 plumose setae along anterior margin.

Pereopods III to V similar, slightly longer than precedents and more setose. Pereopod V (Fig. 42). Basis almost twice length of merus, anterior and posterior margins fringed with elongate fine hairy setae, wide and short conical spines along anterior margin; ischium nearly 1.4 length of merus, posterior margin densely setose bearing many short conical spines, 2 hairy and several elongate simple setae at distal anterior corner, merus slightly longer than carpus, posterior margin setose, many scales at anterior margin; carpus posterior margin fringed with spines, anterior margin bearing scales; propodus nearly 2.8 times longer than dactylus, posterior margin with scales and 2 elongate spines, anterior margin with scales and 3 elongate setae; dactylus twice length of stout curved unguis, short setae distally placed.

Pleopods sympod nearly 2.6 times shorter than endopod, 2 coupling setae in the basal third of inner margin, outer margin setose with distal elongate simple seta. Pleopod 1 (Fig. 43) endopod nearly 1.2 times longer than exopod, 5 translucent scales apically; pleopods 2 to 5 similar, having endopods with 8 apical scales, exopods with 8 or 9 scales.

Uropods (Fig. 47). Outer margin of sympod setose, dorsal surface with 1 long seta; endopod surpassing pleotelson apex, inner margin fringed with short simple setae, many plumose setae subapically and apically; exopod subequal in length to endopod, row of short setae and 3 elongate setae along outer margin, apex bearing many plumose setae.

Pleotelson (Fig. 47) slightly longer than wide, tapering posteriorly, ending in 2 elongate setae; 2 short and 2 long setae placed middorsally at basal $\frac{1}{3}$ and distal $\frac{2}{3}$, respectively.

Remarks. Adult males varied from 4.7 to 5.8 mm long, whereas juvenile males ranged from 2.2 to 2.5 mm long.

Ovigerous female, 5.2 mm long (Fig. 44). Body about 2.3 times longer than wide, widest at posterior margins of pereonites IV and V, yellowish, many setae along lateral margins of pereonites. Cephalothorax thrice as long as pleon. Head about 3.7 times wider than long, mouthparts visible in dorsal view. Pereonite I embedded in pereonite II, half length of pereonite II; pereonite II as long as III, both having lateral margins directed forwards; pereonite V longest, slightly longer than pereonite IV, 1.3 times longer than following pereonite; pereonite VI having incomplete anterolateral suture; pereonite VII shortest, about 10 times shorter than pereonite V. Pleonites subequal in length, coxal plates visible dorsally on all pleopods; pleotelson slightly wider than long, uropods surpassing pleotelson apex. Pylopod elongate (Fig. 45); article 1 twice longer than wide, lateral margin setose; article 2 wider and longer than following article, lateral and distal margins setose, some long setae distally; article 3 almost twice narrower than precedent article, lateral and apical margins bearing many short and 5 elongate setae respectively; apical article short, globose, about 14 times shorter than article 3, margins bare. Pereopods all similar to pereopod I. Pereopod I (fig. 46) basis anterior margin with 3 long setae; from ischium to carpus posterior margin fringed with short setae and scattered elongate ones; propodus twice longer than dactylus, many short setae and 2 spines placed at posterior margin; unguis curved, half length of dactylus.

Remarks. Of the 50 specimens which were collected 14 were adult females. Only one pranzia was found. Gravid females had 50-60 eggs.

Distribution. Southeastern Brazil: São Paulo State, Ubatuba shelf break and slope.

Etymology. The species is named after my older son, Ricardo.

Habitat. *G. ricardoi* was found in muddy and sandy bottoms of the upper and central continental slope, between 134 and 530 m depth, with increased abundance at 320 m depth.

Taxonomic discussion. *Gnathia ricardoi* differs from all other described species of the genus by having the head broad and deeply excavated dorsally.

Ecological discussion

The three new species are quite different from each other morphologically. They also can be distinguished by their bathymetric distribution. *Gnathia ubatuba* occurs from inner shelf to the slope (33 to 320 m); the other two species are restricted to deeper and narrower ranges: *G. andrei* was collected between 134 and 180 m depth and *G. ricardoi* between 134 and 530 m. The depth distribution of the three species of gnathiid found in the continental shelf and upper slope in Ubatuba region is shown in Table 1.

Gnathia ubatuba occurred most abundantly in the warm waters of the Coastal Water, a tropical water mass ranging between 20 and 25 °C, even though many specimens were found in the deep and dense cold waters (13 to 17 °C) of the South Atlantic Central Water. This result shows that the species tolerate a wide range of temperature, salinity and depth, being numerous both in coastal and offshore waters.

Gnathia andrei exclusively was collected in the shelf break zone, which seems to indicate that species abundance may be related more to habitat type than to depth. This zone has a hard bottom formed by concretions of calcareous algae mixed with dead corals. In contrast, the deepest species, *Gnathia ricardoi*, also occurred in the shelf break area but was more frequent below 320 m.

Tab. 1. Distribution of the Gnathiidea in Ubatuba continental shelf and slope.

STA	DATE	LAT. (°S)	LONG (°W)	DEPTH (m)	TEMP (°C)	<i>Gnathia ubatuba</i>	<i>Gnathia andrei</i>	<i>Gnathia ricardoi</i>	<i>Bathynathia magnifica</i>
1	26.10.85	2345	4500	46	16.54	3	0	0	0
2	26.10.85	2337	4503	35	16.79	1	0	0	0
17	22.01.86	2334	4448	44	15.83	2	0	0	0
21	18.04.86	2334	4507	20	25.13	1	0	0	0
32	10.07.86	2346	4509	35	22.20	1	0	0	0
34	11.07.86	2334	4443	48	17.93	1	0	0	0
4851	16.12.85	2336	4446	48	14.45	4	0	0	0
4852	16.12.85	2349	4439	70	15.03	58	0	0	0
4853	16.12.85	2401	4433	104	13.73	1	0	0	0
4854	17.12.85	2347	4458	47	14.87	1	0	0	0
4855	17.12.85	2357	4452	73	14.33	7	0	0	0
4856	17.12.85	2413	4445	116	14.13	39	0	0	0
4857	18.12.85	2351	4507	48	15.45	1	0	0	0
4858	18.12.85	2408	4501	76	14.43	16	0	0	0
4859	18.12.85	2422	4454	102	14.81	13	0	0	0
4931	23.07.86	2419	4413	188	-	74	0	0	0
4946	26.07.86	2336	4439	50	21.80	101	0	0	0
4947	26.07.86	2349	4439	77	16.72	5	0	0	0
4948	26.07.86	2401	4433	108	15.61	78	0	0	0
4949	27.07.86	2347	4458	50	21.38	1	0	0	0
4950	27.07.86	2357	4453	75	17.37	31	0	0	0
4951	27.07.86	2413	4445	117	15.81	56	0	0	0
4952	28.07.86	2356	4507	48	21.92	1	0	0	0
4953	28.07.86	2408	4501	79	18.66	19	0	0	0
4954	28.07.86	2422	4454	101	18.13	59	0	0	0
5120	10.07.87	2419	4440	134	15.17	163	10	0	0
5148	12.07.87	2414	4432	134	14.65	16	12	11	0
5170	13.07.87	2409	4422	136	14.75	106	11	0	0
5191	20.07.87	2436	4433	184	16.50	0	0	1	0
5192	20.07.87	2423	4424	180	15.28	2	2	0	0
5360	06.12.88	2435	4432	248	14.61	5	0	0	0
5361	06.12.88	2442	4430	320	15.14	2	0	10	0
5362	07.12.88	2448	4429	530	13.36	0	0	2	0
5365	07.12.88	2425	4416	320	12.51	5	0	13	0
5366	07.12.88	2422	4418	240	13.41	15	0	0	1
5361	08.12.88	2434	4426	350	13.25	0	0	6	0
5368	08.12.88	2431	4428	250	13.40	2	0	7	0

Even though *G. ubatuba* and *G. ricardo* occupy a larger depth range, they also were very numerous on the hard substrata of the shelf break zone. That calcareous bottom, rich in small cavities, seems to be a suitable habitat for the gnathiids studies. *Gnathia abyssorum* and *G. calva*, among others (Klitgaard 1991, Wägele 1988) were abundant in hard bottoms with sponges, due to the narrow channels that exists in the sponges. The present data show that the abundance of the *Gnathia* studied seems to be strongly related to the kind and structure of the hard substrata present in the Brazilian shelf, rather than to depth.

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